Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

NATIONAL GUIDELINE CLEARINGHOUSE

General

Guideline Title

The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America.

Bibliographic Source(s)

Bradley JS, Byington CL, Shah SS, Alverson B, Carter ER, Harrison C, Kaplan SL, Mace SE, McCracken GH Jr, Moore MR, St Peter SD, Stockwell JA, Swanson JT. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis. 2011 Oct;53(7):e25-76. [340 references] PubMed

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Quality of evidence (high-quality, moderate-quality, low-quality, very low-quality) and strength of recommendation (strong, weak) ratings are defined at the end of the "Major Recommendations" field.

Site-of-Care Management Decisions

I. When Does a Child or Infant with Community-Acquired Pneumonia (CAP) Require Hospitalization?

Recommendations

1. Children and infants who have moderate to severe CAP, as defined by several factors, including respiratory distress and hypoxemia (sustained saturation of peripheral oxygen [SpO_2], <90% at sea level) (see Table 3 in the original guideline document) should be hospitalized for management, including skilled pediatric nursing care. (strong recommendation; high-quality evidence)
2. Infants less than 3–6 months of age with suspected bacterial CAP are likely to benefit from hospitalization. (strong recommendation; low-quality evidence)
3. Children and infants with suspected or documented CAP caused by a pathogen with increased virulence, such as community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) should be hospitalized. (strong recommendation; low-quality evidence)
4. Children and infants for whom there is concern about careful observation at home or who are unable to comply with therapy or unable to be followed up should be hospitalized. (strong recommendation; low-quality evidence)

II. When Should a Child with CAP Be Admitted to an Intensive Care Unit (ICU) or a Unit with Continuous Cardiorespiratory Monitoring?

Recommendations

5. A child should be admitted to an ICU if the child requires invasive ventilation via a nonpermanent artificial airway (e.g., endotracheal tube). (strong recommendation; high-quality evidence)
6. A child should be admitted to an ICU or a unit with continuous cardiorespiratory monitoring capabilities if the child acutely requires use of noninvasive positive pressure ventilation (e.g., continuous positive airway pressure or bi-level positive airway pressure). (strong recommendation; very low-quality evidence)
7. A child should be admitted to an ICU or a unit with continuous cardiorespiratory monitoring capabilities if the child has impending respiratory failure. (strong recommendation; moderate-quality evidence)
8. A child should be admitted to an ICU or a unit with continuous cardiorespiratory monitoring capabilities if the child has sustained tachycardia, inadequate blood pressure, or need for pharmacologic support of blood pressure or perfusion. (strong recommendation; moderate-quality evidence)
9. A child should be admitted to an ICU if the pulse oximetry measurement is <92% on inspired oxygen of ≥0.50. (strong recommendation; low-quality evidence)
10. A child should be admitted to an ICU or a unit with continuous cardiorespiratory monitoring capabilities if the child has altered mental status, whether due to hypercarbia or hypoxemia as a result of pneumonia. (strong recommendation; low-quality evidence)
11. Severity of illness scores should not be used as the sole criteria for ICU admission but should be used in the context of other clinical, laboratory, and radiologic findings. (strong recommendation; low-quality evidence)

Diagnostic Testing For Pediatric CAP

III. What Diagnostic Laboratory and Imaging Tests Should Be Used in a Child with Suspected CAP in an Outpatient or Inpatient Setting?

Recommendations

Microbiologic Testing

Blood Cultures: Outpatient

12. Blood cultures should not be routinely performed in nontoxic, fully immunized children with CAP managed in the outpatient setting. (strong recommendation; moderate-quality evidence)
13. Blood cultures should be obtained in children who fail to demonstrate clinical improvement and in those who have progressive symptoms or clinical deterioration after initiation of antibiotic therapy. (strong recommendation; moderate-quality evidence)

Blood Cultures: Inpatient

14. Blood cultures should be obtained in children requiring hospitalization for presumed bacterial CAP that is moderate to severe, particularly those with complicated pneumonia. (strong recommendation; low-quality evidence)
15. In improving patients who otherwise meet criteria for discharge, a positive blood culture with identification or susceptibility results pending should not routinely preclude discharge of that patient with appropriate oral or intravenous antimicrobial therapy. The patient can be discharged if close follow-up is assured. (weak recommendation; low-quality evidence)

Follow-up Blood Cultures

16. Repeated blood cultures in children with clear clinical improvement are not necessary to document resolution of pneumococcal bacteremia. (weak recommendation; low-quality evidence)
17. Repeated blood cultures to document resolution of bacteremia should be obtained in children with bacteremia caused by *S. aureus*, regardless of clinical status. (strong recommendation; low-quality evidence)

Sputum Gram Stain and Culture

18. Sputum samples for culture and Gram stain should be obtained in hospitalized children who can produce sputum. (weak recommendation; low-quality evidence)

Urinary Antigen Detection Tests

19. Urinary antigen detection tests are not recommended for the diagnosis of pneumococcal pneumonia in children; false-positive tests are common. (strong recommendation; high-quality evidence)

Testing For Viral Pathogens

20. Sensitive and specific tests for the rapid diagnosis of influenza virus and other respiratory viruses should be used in the evaluation of children with CAP. A positive influenza test may decrease both the need for additional diagnostic studies and antibiotic use, while guiding appropriate use of antiviral agents in both outpatient and inpatient settings. (strong recommendation; high-quality evidence)
21. Antibacterial therapy is not necessary for children, either outpatients or inpatients, with a positive test for influenza virus in the absence of clinical, laboratory, or radiographic findings that suggest bacterial coinfection. (strong recommendation; high-quality evidence)
22. Testing for respiratory viruses other than influenza virus can modify clinical decision making in children with suspected pneumonia, because antibacterial therapy will not routinely be required for these children in the absence of clinical, laboratory, or radiographic findings that suggest bacterial coinfection. (weak recommendation; low-quality evidence)

Testing for Atypical Bacteria

23. Children with signs and symptoms suspicious for *Mycoplasma pneumoniae* should be tested to help guide antibiotic selection. (weak recommendation; moderate-quality evidence)
24. Diagnostic testing for *Chlamydophila pneumoniae* is not recommended as reliable and readily available diagnostic tests do not currently exist. (strong recommendation; high-quality evidence)

Ancillary Diagnostic Testing

Complete Blood Cell Count

25. Routine measurement of the complete blood cell count is not necessary in all children with suspected CAP managed in the outpatient setting, but in those with more serious disease it may provide useful information for clinical management in the context of the clinical examination and other laboratory and imaging studies. (weak recommendation; low-quality evidence)
26. A complete blood cell count should be obtained for patients with severe pneumonia, to be interpreted in the context of the clinical examination and other laboratory and imaging studies. (weak recommendation; low-quality evidence)

Acute-Phase Reactants

27. Acute-phase reactants, such as the erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) concentration, or serum procalcitonin concentration, cannot be used as the sole determinant to distinguish between viral and bacterial causes of CAP. (strong recommendation; high-quality evidence)
28. Acute-phase reactants need not be routinely measured in fully immunized children with CAP who are managed as outpatients, although for more serious disease, acute-phase reactants may provide useful information for clinical management. (strong recommendation; low-quality evidence)
29. In patients with more serious disease, such as those requiring hospitalization or those with pneumonia-associated complications, acute-phase reactants may be used in conjunction with clinical findings to assess response to therapy. (weak recommendation; low-quality evidence)

Pulse Oximetry

30. Pulse oximetry should be performed in all children with pneumonia and suspected hypoxemia. The presence of hypoxemia should guide decisions regarding site of care and further diagnostic testing. (strong recommendation; moderate-quality evidence)

Chest Radiography

Initial Chest Radiographs: Outpatient

31. Routine chest radiographs are not necessary for the confirmation of suspected CAP in patients well enough to be treated in the outpatient setting (after evaluation in the office, clinic, or emergency department setting). (strong recommendation; high-quality evidence)
32. Chest radiographs, posteroanterior and lateral, should be obtained in patients with suspected or documented hypoxemia or significant respiratory distress (see Table 3 in the original guideline document) and in those with failed initial antibiotic therapy to verify the presence or absence of complications of pneumonia, including parapneumonic effusions, necrotizing pneumonia, and pneumothorax. (strong recommendation; moderate-quality evidence)

Initial Chest Radiographs: Inpatient

33. Chest radiographs (posteroanterior and lateral) should be obtained in all patients hospitalized for management of CAP to document the presence, size, and character of parenchymal infiltrates and identify complications of pneumonia that may lead to interventions beyond

antimicrobial agents and supportive medical therapy. (strong recommendation; moderate-quality evidence)

Follow-up Chest Radiograph

34. Repeated chest radiographs are not routinely required in children who recover uneventfully from an episode of CAP. (strong recommendation; moderate-quality evidence)
35. Repeated chest radiographs should be obtained in children who fail to demonstrate clinical improvement and in those who have progressive symptoms or clinical deterioration within 48–72 hours after initiation of antibiotic therapy. (strong recommendation; moderate-quality evidence)
36. Routine daily chest radiography is not recommended in children with pneumonia complicated by parapneumonic effusion after chest tube placement or after video assisted thoracoscopic surgery (VATS), if they remain clinically stable. (strong recommendation; low-quality evidence)
37. Follow-up chest radiographs should be obtained in patients with complicated pneumonia with worsening respiratory distress or clinical instability, or in those with persistent fever that is not responding to therapy over 48–72 hours. (strong recommendation; low-quality evidence)
38. Repeated chest radiographs 4–6 weeks after the diagnosis of CAP should be obtained in patients with recurrent pneumonia involving the same lobe and in patients with lobar collapse at initial chest radiography with suspicion of an anatomic anomaly, chest mass, or foreign body aspiration. (strong recommendation; moderate quality evidence)

IV. What Additional Diagnostic Tests Should Be Used in a Child with Severe or Life-Threatening CAP?

Recommendations

39. The clinician should obtain tracheal aspirates for Gram stain and culture, as well as clinically and epidemiologically guided testing for viral pathogens, including influenza virus, at the time of initial endotracheal tube placement in children requiring mechanical ventilation. (strong recommendation; low-quality evidence)
40. Bronchoscopic or blind protected specimen brush sampling, bronchoalveolar lavage (BAL), percutaneous lung aspiration, or open lung biopsy should be reserved for the immunocompetent child with severe CAP if initial diagnostic tests are not positive. (weak recommendation; low-quality evidence)

Anti-Infective Treatment

V. Which Anti-Infective Therapy Should Be Provided to a Child with Suspected CAP in Both Outpatient and Inpatient Settings?

Recommendations

Outpatients

41. Antimicrobial therapy is not routinely required for preschool-aged children with CAP, because viral pathogens are responsible for the great majority of clinical disease. (strong recommendation; high-quality evidence)
42. Amoxicillin should be used as first-line therapy for previously healthy, appropriately immunized infants and preschool children with mild to moderate CAP suspected to be of bacterial origin. Amoxicillin provides appropriate coverage for *Streptococcus pneumoniae*, the most prominent invasive bacterial pathogen. Table 5 in the original guideline document lists preferred agents and alternative agents for children allergic to amoxicillin. (strong recommendation; moderate-quality evidence)
43. Amoxicillin should be used as first-line therapy for previously healthy appropriately immunized school-aged children and adolescents with mild to moderate CAP for *S. pneumoniae*, the most prominent invasive bacterial pathogen. Atypical bacterial pathogens (e.g., *M. pneumoniae*), and less common lower respiratory tract bacterial pathogens, as discussed in the Evidence Summary of the original guideline, should also be considered in management decisions. (strong recommendation; moderate-quality evidence)
44. Macrolide antibiotics should be prescribed for treatment of children (primarily school-aged children and adolescents) evaluated in an outpatient setting with findings compatible with CAP caused by atypical pathogens. Laboratory testing for *M. pneumoniae* should be performed if available in a clinically relevant time frame. Table 5 in the original guideline document lists preferred and alternative agents for atypical pathogens. (weak recommendation; moderate-quality evidence)
45. Influenza antiviral therapy (see Table 6 in the original guideline document) should be administered as soon as possible to children with moderate to severe CAP consistent with influenza virus infection during widespread local circulation of influenza viruses, particularly for those with clinically worsening disease documented at the time of an outpatient visit. Because early antiviral treatment has been shown to provide maximal benefit, treatment should not be delayed until confirmation of positive influenza test results. Negative results of influenza diagnostic tests, especially rapid antigen tests, do not conclusively exclude influenza disease. Treatment after 48 hours of symptomatic infection may still provide clinical benefit to those with more severe disease. (strong recommendation; moderate-quality evidence)

Inpatients

46. Ampicillin or penicillin G should be administered to the fully immunized infant or school-aged child admitted to a hospital ward with CAP when local epidemiologic data document lack of substantial high-level penicillin resistance for invasive *S. pneumoniae*. Other antimicrobial agents for empiric therapy are provided in Table 7 in the original guideline document. (strong recommendation; moderate-quality evidence)
47. Empiric therapy with a third-generation parenteral cephalosporin (ceftriaxone or cefotaxime) should be prescribed for hospitalized infants and children who are not fully immunized, in regions where local epidemiology of invasive pneumococcal strains documents high-level penicillin resistance, or for infants and children with life threatening infection, including those with empyema (see Table 7 in the original guideline document). Non–β-lactam agents, such as vancomycin, have not been shown to be more effective than third-generation cephalosporins in the treatment of pneumococcal pneumonia for the degree of resistance noted currently in North America. (weak recommendation; moderate-quality evidence)
48. Empiric combination therapy with a macrolide (oral or parenteral), in addition to a β-lactam antibiotic, should be prescribed for the hospitalized child for whom *M. pneumoniae* and *C. pneumoniae* are significant considerations; diagnostic testing should be performed if available in a clinically relevant time frame (see Table 7 in the original guideline document). (weak recommendation; moderate-quality evidence)
49. Vancomycin or clindamycin (based on local susceptibility data) should be provided in addition to β-lactam therapy if clinical, laboratory, or imaging characteristics are consistent with infection caused by *S. aureus* (see Table 7 in the original guideline document). (strong recommendation; low-quality evidence)

VI. How Can Resistance to Antimicrobials Be Minimized?

Recommendations

50. Antibiotic exposure selects for antibiotic resistance; therefore, limiting exposure to any antibiotic, whenever possible, is preferred. (strong recommendation; moderate-quality evidence)
51. Limiting the spectrum of activity of antimicrobials to that specifically required to treat the identified pathogen is preferred. (strong recommendation; low-quality evidence)
52. Using the proper dosage of antimicrobial to be able to achieve a minimal effective concentration at the site of infection is important to decrease the development of resistance. (strong recommendation; low-quality evidence)
53. Treatment for the shortest effective duration will minimize exposure of both pathogens and normal microbiota to antimicrobials and minimize the selection for resistance. (strong recommendation; low-quality evidence)

VII. What Is the Appropriate Duration of Antimicrobial Therapy for CAP?

Recommendations

54. Treatment courses of 10 days have been best studied, although shorter courses may be just as effective, particularly for more mild disease managed on an outpatient basis. (strong recommendation; moderate-quality evidence)
55. Infections caused by certain pathogens, notably CA-MRSA, may require longer treatment than those caused by *S. pneumoniae*. (strong recommendation; moderate-quality evidence)

VIII. How Should the Clinician Follow the Child with CAP for the Expected Response to Therapy?

Recommendation

56. Children on adequate therapy should demonstrate clinical and laboratory signs of improvement within 48–72 hours. For children whose condition deteriorates after admission and initiation of antimicrobial therapy or who show no improvement within 48–72 hours, further investigation should be performed. (strong recommendation; moderate-quality evidence)

Adjunctive Surgical and Non–Anti-Infective Therapy for Pediatric CAP

IX. How Should a Parapneumonic Effusion Be Identified?

Recommendation

57. History and physical examination may be suggestive of parapneumonic effusion in children suspected of having CAP, but chest radiography should be used to confirm the presence of pleural fluid. If the chest radiograph is not conclusive, then further imaging with chest ultrasound or computed tomography (CT) is recommended. (strong recommendation; high-quality evidence)

X. What Factors Are Important in Determining Whether Drainage of the Parapneumonic Effusion Is Required?

Recommendations

58. The size of the effusion is an important factor that determines management (see Table 8 and Figure 1 in the original guideline document). (strong recommendation; moderate-quality evidence)
59. The child's degree of respiratory compromise is an important factor that determines management of parapneumonic effusions (see Table 8 and Figure 1 in the original guideline document). (strong recommendation; moderate quality evidence)

XI. What Laboratory Testing Should Be Performed on Pleural Fluid?

Recommendation

60. Gram stain and bacterial culture of pleural fluid should be performed whenever a pleural fluid specimen is obtained. (strong recommendation; high-quality evidence)
61. Antigen testing or nucleic acid amplification through polymerase chain reaction (PCR) increases the detection of pathogens in pleural fluid and may be useful for management. (strong recommendation; moderate-quality evidence)
62. Analysis of pleural fluid parameters, such as pH and levels of glucose, protein, and lactate dehydrogenase, rarely change patient management and are not recommended. (weak recommendation; very low-quality evidence)
63. Analysis of the pleural fluid white blood cell (WBC) count, with cell differential analysis, is recommended primarily to help differentiate bacterial from mycobacterial etiologies and from malignancy. (weak recommendation; moderate-quality evidence)

XII. What Are the Drainage Options for Parapneumonic Effusions?

Recommendations

64. Small, uncomplicated parapneumonic effusions should not routinely be drained and can be treated with antibiotic therapy alone. (strong recommendation; moderate-quality evidence)
65. Moderate parapneumonic effusions associated with respiratory distress, large parapneumonic effusions, or documented purulent effusions should be drained. (strong recommendation; moderate-quality evidence)
66. Both chest thoracostomy tube drainage with the addition of fibrinolytic agents and VATS have been demonstrated to be effective methods of treatment. The choice of drainage procedure depends on local expertise. Both of these methods are associated with decreased morbidity compared with chest tube drainage alone. However, in patients with moderate-to-large effusions that are free flowing (no loculations), placement of a chest tube without fibrinolytic agents is a reasonable first option. (strong recommendation; high-quality evidence)

XIII. When Should VATS or Open Decortication Be Considered in Patients Who Have Had Chest Tube Drainage, with or without Fibrinolytic Therapy?

Recommendation

67. VATS should be performed when there is persistence of moderate-large effusions and ongoing respiratory compromise despite ~2–3 days of management with a chest tube and completion of fibrinolytic therapy. Open chest debridement with decortication represents another option for management of these children but is associated with higher morbidity rates. (strong recommendation; low-quality evidence)

XIV. When Should a Chest Tube Be Removed Either after Primary Drainage or VATS?

Recommendations

68. A chest tube can be removed in the absence of an intrathoracic air leak and when pleural fluid drainage is <1 mL/kg/24 h, usually calculated over the last 12 hours. (strong recommendation; very low-quality evidence)

XV. What Antibiotic Therapy and Duration Is Indicated for the Treatment of Parapneumonic Effusion/Empyema?

Recommendations

69. When the blood or pleural fluid bacterial culture identifies a pathogenic isolate, antibiotic susceptibility should be used to determine the antibiotic regimen. (strong recommendation; high-quality evidence)
70. In the case of culture-negative parapneumonic effusions, antibiotic selection should be based on the treatment recommendations for patients hospitalized with CAP (see Evidence Summary for Recommendations 46–49 in the original guideline document). (strong recommendation; moderate-quality evidence)

71. The duration of antibiotic treatment depends on the adequacy of drainage and on the clinical response demonstrated for each patient. In most children, antibiotic treatment for 2–4 weeks is adequate. (strong recommendation; low-quality evidence)

Management of the Child Not Responding to Treatment

XVI. What Is the Appropriate Management of a Child Who Is Not Responding to Treatment for CAP?

Recommendation

72. Children who are not responding to initial therapy after 48–72 hours should be managed by one or more of the following:
    a. Clinical and laboratory assessment of the current severity of illness and anticipated progression in order to determine whether higher levels of care or support are required. (strong recommendation; low-quality evidence)
    b. Imaging evaluation to assess the extent and progression of the pneumonic or parapneumonic process. (weak recommendation; low-quality evidence)
    c. Further investigation to identify whether the original pathogen persists, the original pathogen has developed resistance to the agent used, or there is a new secondary infecting agent. (weak recommendation; low-quality evidence)
73. A BAL specimen should be obtained for Gram stain and culture for the mechanically ventilated child. (strong recommendation; moderate-quality evidence)
74. A percutaneous lung aspirate should be obtained for Gram stain and culture in the persistently and seriously ill child for whom previous investigations have not yielded a microbiologic diagnosis. (weak recommendation; low-quality evidence)
75. An open lung biopsy for Gram stain and culture should be obtained in the persistently and critically ill, mechanically ventilated child in whom previous investigations have not yielded a microbiologic diagnosis. (weak recommendation; low-quality evidence)

XVII. How Should Nonresponders with Pulmonary Abscess or Necrotizing Pneumonia Be Managed?

Recommendation

76. A pulmonary abscess or necrotizing pneumonia identified in a nonresponding patient can be initially treated with intravenous antibiotics. Well-defined peripheral abscesses without connection to the bronchial tree may be drained under imaging-guided procedures either by aspiration or with a drainage catheter that remains in place, but most abscesses will drain through the bronchial tree and heal without surgical or invasive intervention. (weak recommendation; very low-quality evidence)

Discharge Criteria

XVIII. When Can a Hospitalized Child with CAP Be Safely Discharged?

Recommendations

77. Patients are eligible for discharge when they have documented overall clinical improvement, including level of activity, appetite, and decreased fever for at least 12–24 hours. (strong recommendation; very low-quality evidence)
78. Patients are eligible for discharge when they demonstrate consistent pulse oximetry measurements >90% in room air for at least 12–24 hours. (strong recommendation; moderate quality evidence)
79. Patients are eligible for discharge only if they demonstrate stable and/or baseline mental status. (strong recommendation; very low-quality evidence)
80. Patients are not eligible for discharge if they have substantially increased work of breathing or sustained tachypnea or tachycardia. (strong recommendation; high-quality evidence)
81. Patients should have documentation that they can tolerate their home anti-infective regimen, whether oral or intravenous, and home oxygen regimen, if applicable, before hospital discharge. (strong recommendation; low-quality evidence)
82. For infants or young children requiring outpatient oral antibiotic therapy, clinicians should demonstrate that parents are able to administer and children are able to comply adequately with taking those antibiotics before discharge. (weak recommendation; very low-quality evidence)
83. For children who have had a chest tube and meet the requirements listed above, hospital discharge is appropriate after the chest tube has been removed for 12–24 hours, either if there is no clinical evidence of deterioration since removal or if a chest radiograph, obtained for clinical concerns, shows no significant reaccumulation of a parapneumonic effusion or pneumothorax. (strong recommendation; very low-quality evidence)
84. In infants and children with barriers to care, including concern about careful observation at home, inability to comply with therapy, or lack of availability for follow-up, these issues should be identified and addressed before discharge. (weak recommendation; very low-quality evidence)

XIX. When Is Parenteral Outpatient Therapy Indicated, in Contrast to Oral Step-Down Therapy?

Recommendations

85. Outpatient parenteral antibiotic therapy should be offered to families of children no longer requiring skilled nursing care in an acute care facility but with a demonstrated need for ongoing parenteral therapy. (weak recommendation; moderate-quality evidence)
86. Outpatient parenteral antibiotic therapy should be offered through a skilled pediatric home nursing program or through daily intramuscular injections at an appropriate pediatric outpatient facility. (weak recommendation; low-quality evidence)
87. Conversion to oral outpatient step-down therapy, when possible, is preferred to parenteral outpatient therapy. (strong recommendation; low-quality evidence)

Prevention

XX. Can Pediatric CAP Be Prevented?

Recommendations

88. Children should be immunized with vaccines for bacterial pathogens, including *S. pneumoniae*, *Haemophilus influenzae* type b, and pertussis to prevent CAP. (strong recommendation; high-quality evidence)
89. All infants ≥6 months of age and all children and adolescents should be immunized annually with vaccines for influenza virus to prevent CAP. (strong recommendation; high-quality evidence)
90. Parents and caretakers of infants <6 months of age, including pregnant adolescents, should be immunized with vaccines for influenza virus and pertussis to protect the infants from exposure. (strong recommendation; low-quality evidence)
91. Pneumococcal CAP after influenza virus infection is decreased by immunization against influenza virus. (strong recommendation; low-quality evidence)
92. High-risk infants should be provided immune prophylaxis with respiratory syncytial virus (RSV)–specific monoclonal antibody to decrease the risk of severe pneumonia and hospitalization caused by RSV. (strong recommendation; high-quality evidence)

Definitions:

Strength of Recommendations and Quality of Evidence			
Strength of Recommendation and Quality of Evidence	Clarity of Balance between Desirable and Undesirable Effects	Methodologic Quality of Supporting Evidence (examples)	Implications
Strong Recommendation			
High-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Consistent evidence from well performed randomized controlled trials (RCTs) or exceptionally strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances; further research is unlikely to change confidence in the estimate of effect.
Moderate-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect, or imprecise) or exceptionally strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances; further research (if performed) is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
Low-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence for ≥1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence	Recommendation may change when higher quality evidence becomes available; further research (if performed) is likely to have an important impact on confidence in the estimate of

Strength of Recommendations and Quality of Evidence			
Strength of Recommendation and Quality of Evidence	Clarity of Balance between Desirable and Undesirable Effects	Methodologic Quality of Supporting Evidence (examples)	Implications
Very low-quality evidence (rarely applicable)	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence for ≥1 critical outcome from unsystematic clinical observations or very indirect evidence	Recommendation may change when higher quality evidence becomes available; any estimate of effect for ≥1 critical outcome is very uncertain.
Weak Recommendation			
High-quality evidence	Desirable effects closely balanced with undesirable effects	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies	The best action may differ depending on circumstances or patients or societal values; further research is unlikely to change confidence in the estimate of effect.
Moderate-quality evidence	Desirable effects closely balanced with undesirable effects	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect, or imprecise) or exceptionally strong evidence from unbiased observational studies	Alternative approaches are likely to be better for some patients under some circumstances; further research (if performed) is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
Low-quality evidence	Uncertainty in the estimates of desirable effects, harms, and burden; desirable effects, harms, and burden may be closely balanced	Evidence for ≥1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence	Other alternatives may be equally reasonable; further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
Very low-quality evidence	Major uncertainty in estimates of desirable effects, harms, and burden; desirable effects may or may not be balanced with undesirable effects	Evidence for ≥1 critical outcome from unsystematic clinical observations or very indirect evidence	Other alternatives may be equally reasonable; any estimate of effect, for at ≥1 critical outcome, is very uncertain.

Clinical Algorithm(s)

An algorithm is provided in the original guideline document for management of pneumonia with parapneumonic effusion.

Scope

Disease/Condition(s)

Community-acquired pneumonia (CAP)

Note: Community-acquired mycobacterial and fungal pneumonia are not discussed.

Guideline Category

Diagnosis

Management

Prevention

Treatment

Clinical Specialty

Critical Care

Emergency Medicine

Family Practice

Infectious Diseases

Pediatrics

Preventive Medicine

Pulmonary Medicine

Radiology

Surgery

Intended Users

Advanced Practice Nurses

Physician Assistants

Physicians

Respiratory Care Practitioners

Guideline Objective(s)

- To provide guidance in the care of otherwise healthy infants and children and addresses practical questions of diagnosis and management of community-acquired pneumonia (CAP) evaluated in outpatient (offices, urgent care clinics, emergency departments) or inpatient settings in the United States
- To decrease morbidity and mortality rates for CAP in children older than 3 months of age by presenting recommendations for clinical management that can be applied in individual cases if deemed appropriate by the treating clinician

Target Population

Otherwise healthy infants and children older than 3 months of age who have community-acquired pneumonia (CAP)

Note: Management of neonates and young infants through the first 3 months, immunocompromised children, children receiving home mechanical ventilation, and children with chronic conditions or underlying lung disease, such as cystic fibrosis, are beyond the scope of these guidelines and are not discussed.

Interventions and Practices Considered

Diagnosis/Evaluation

1. Evaluation for hospitalization and intensive care unit admission based on severity of illness and other clinical, radiologic, and laboratory

findings

2. Diagnostic laboratory and imaging tests for community-acquired pneumonia
    - Microbiologic tests (blood cultures, sputum Gram stain and culture)
    - Testing for viral pathogens
    - Testing for atypical bacteria
    - Ancillary diagnostic tests (e.g., complete blood count, acute-phase reactants, pulse oximetry)
    - Chest radiography
3. Additional diagnostic tests in severe or life-threatening CAP
    - Tracheal aspirates for Gram stain and culture; clinically and epidemiologically guided testing for viral pathogens
    - Bronchoscopic or blind protected specimen brush sampling, bronchoalveolar lavage (BAL), percutaneous lung aspiration, or open lung biopsy

Treatment/Management/Prevention

1. Outpatient anti-infective treatment
    - Amoxicillin
    - Macrolide antibiotics
    - Influenza antiviral therapy
2. Inpatient anti-infective treatment
    - Ampicillin or penicillin G
    - Empiric therapy with a third-generation parenteral cephalosporin
    - Empiric combination therapy with a macrolide (oral or parenteral), in addition to a beta-lactam antibiotic
    - Vancomycin or clindamycin in addition to a beta-lactam (for methicillin-resistant *Staphylococcus aureus* [MRSA])
3. Minimizing resistance to antimicrobials
4. Duration of antimicrobial treatment
5. Following for response to treatment
6. Chest thoracostomy tube drainage with or without the addition of fibrinolytic agents
7. Video-assisted thoracoscopic surgery (VATS)
8. Antibiotic therapy for the treatment of parapneumonic effusion/empyema
9. Management of non-responding patients
10. Discharge criteria
11. Parenteral outpatient therapy versus oral step-down therapy
12. Prevention of CAP
    - Immunization of children with vaccines for bacterial pathogens, including *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and pertussis
    - Immunization of children and infants with influenza vaccine
    - Immunization of parents and caretakers with vaccines for influenza virus and pertussis
    - Immune prophylaxis with respiratory syncytial virus (RSV)–specific monoclonal antibody in high-risk infants

Major Outcomes Considered

- Sensitivity, specificity, and predictive value of diagnostic tests
- Morbidity and mortality rates for community-acquired pneumonia (CAP) in children older than 3 months of age
- Effectiveness of treatment for CAP

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Clinical questions were developed by the writing group and approved by the IDSA Standards and Practice Guidelines Committee (SPGC). Computerized literature searches of the National Library of Medicine PubMed database were performed to identify data published through May 2010, although more recent articles with particular relevance to these guidelines have been included. Relevant abstracts from recent professional meetings and existing guidelines on pediatric community-acquired pneumonia (CAP) were also identified, collected, and reviewed.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

See the "Rating Scheme for the Strength of the Recommendations" field.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

As with all Infectious Diseases Society of America (IDSA) clinical practice guidelines initiated after 1 October 2008, the expert panel employed the GRADE (Grades of Recommendation Assessment, Development and Evaluation) method of assigning strength of recommendation and quality of the evidence to each recommendation (see the "Rating Scheme for the Strength of the Recommendations" fields).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The Pediatric Infectious Diseases Society (PIDS) and the Infectious Diseases Society of America (IDSA) Standards and Practice Guidelines Committee (SPGC) convened experts in pediatric community-acquired pneumonia (CAP) from the fields of community pediatrics, public health, and the pediatric subspecialties of critical care medicine, emergency medicine, hospital medicine, infectious diseases, pulmonology, and surgery. Panel participants included representatives from the following collaborating organizations: American Academy of Pediatrics (AAP), American College of Emergency Physicians, American Thoracic Society–Pediatric Section, Society for Hospital Medicine, the Society of Critical Care Medicine, and the American Pediatric Surgical Association. In addition, expert consultants in diagnostic microbiology including virology, and interventional radiology were asked to review and provide feedback on the draft guidelines.

Consensus Development Based on Evidence

The expert panel met initially on 3 occasions via teleconference to complete the organizational work of the guideline, and in person at the 2009 Annual Meeting of the IDSA. Within the panel, subgroups were formed for each clinical question. Each subgroup reviewed the literature relevant

to that clinical question and was responsible for drafting the recommendation(s) and evidence summaries for their assigned section. The drafts were circulated within the panel for commentary and discussed in additional conference calls and during a face-to-face meeting held in conjunction with the 2010 Pediatric Academic Societies meeting. Further refinement of the recommendations and evidence summaries occurred in 4 subsequent teleconference calls.

Rating Scheme for the Strength of the Recommendations

Strength of Recommendations and Quality of Evidence			
Strength of Recommendation and Quality of Evidence	Clarity of Balance between Desirable and Undesirable Effects	Methodologic Quality of Supporting Evidence (examples)	Implications
Strong Recommendation			
High-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Consistent evidence from well performed randomized controlled trials (RCTs) or exceptionally strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances; further research is unlikely to change confidence in the estimate of effect.
Moderate-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect, or imprecise) or exceptionally strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances; further research (if performed) is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
Low-quality evidence	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence for ≥1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence	Recommendation may change when higher quality evidence becomes available; further research (if performed) is likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
Very low-quality evidence (rarely applicable)	Desirable effects clearly outweigh undesirable effects, or vice versa	Evidence for ≥1 critical outcome from unsystematic clinical observations or very indirect evidence	Recommendation may change when higher quality evidence becomes available; any estimate of effect for ≥1 critical outcome is very uncertain.
Weak Recommendation			
High-quality evidence	Desirable effects closely balanced with undesirable effects	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies	The best action may differ depending on circumstances or patients or societal values; further research is unlikely to change confidence in the estimate of effect.
Moderate-quality evidence	Desirable effects closely balanced with undesirable effects	Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect, or imprecise) or	Alternative approaches are likely to be better for some patients under some circumstances; further research (if performed) is

Strength of Recommendations and Quality of Evidence			
Strength of Recommendation and Quality of Evidence	Clarity of Balance between Desirable and Undesirable Effects	Methodologic Quality of Supporting Evidence (examples)	Implications
Low-quality evidence	Uncertainty in the estimates of desirable effects, harms, and burden; desirable effects, harms, and burden may be closely balanced	Evidence for ≥1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence	Other alternatives may be equally reasonable; further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
Very low-quality evidence	Major uncertainty in estimates of desirable effects, harms, and burden; desirable effects may or may not be balanced with undesirable effects	Evidence for ≥1 critical outcome from unsystematic clinical observations or very indirect evidence	Other alternatives may be equally reasonable; any estimate of effect, for at ≥1 critical outcome, is very uncertain.
		exceptionally strong evidence from unbiased observational studies	likely to have an important impact on confidence in the estimate of effect and may change the estimate.

Cost Analysis

Cost Analysis

The medical costs of caring for a child with CAP are $1464 per episode (in 1997 dollars). The mean costs for the subset of patients requiring hospitalization are approximately $12 000 per episode. Contributing to the family burden are parental days of work loss, ranging from 2 days for CAP treated in the ambulatory setting to 4 days for CAP requiring hospitalization, and family stress, leading to repercussions for parents' health and family morale. Cost is not considered a primary outcome for childhood pneumonia. However, cost may be an important factor in choosing among therapies with similar efficacy. Therefore, studies examining the comparative effectiveness of different treatment strategies for uncomplicated pneumonia and severe pneumonia complicated by parapneumonic effusions, empyema, abscesses or necrosis should examine cost as a secondary outcome measure. Cost analyses may also include nonmedical costs, such as lost parental income.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

All members of the panel participated in the preparation and review of the draft guidelines. Feedback was solicited from external peer reviewers and from the organizations represented on the expert panel. The guidelines were reviewed and approved by the Pediatric Infectious Diseases Society (PIDS) Clinical Affairs Committee, the Infectious Diseases Society of America (IDSA) Standards and Practice Guidelines Committee (SPGC), the Council of the PIDS, and the Board of Directors of the IDSA before dissemination.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Decreased morbidity and mortality rates for community-acquired pneumonia (CAP) in children
- Standardized outcomes that can be measured and compared will allow for the establishment of benchmarks for the care of children with CAP

Potential Harms

- Drug-related adverse effects
- Development of drug-resistant organisms
- Complications of invasive diagnostic and therapeutic procedures

Qualifying Statements

Qualifying Statements

The recommendations in this report do not represent an official document of the Centers for Disease Control and Prevention. It is important to realize that guidelines cannot always account for individual variation among patients. They are not intended to supplant physician judgment with respect to particular patients or special clinical situations. The Infectious Diseases Society of America (IDSA) considers adherence to these guidelines to be voluntary, with the ultimate determination regarding their application to be made by the physician in the light of each patient's individual circumstances.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Clinical Algorithm

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Bradley JS, Byington CL, Shah SS, Alverson B, Carter ER, Harrison C, Kaplan SL, Mace SE, McCracken GH Jr, Moore MR, St Peter SD, Stockwell JA, Swanson JT. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis. 2011 Oct;53(7):e25-76. [340 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2011 Oct

Guideline Developer(s)

Infectious Diseases Society of America - Medical Specialty Society

Pediatric Infectious Diseases Society - Medical Specialty Society

Source(s) of Funding

Infectious Diseases Society of America

Guideline Committee

Expert Panel

Composition of Group That Authored the Guideline

Panel Members: John S. Bradley, Department of Pediatrics, University of California San Diego School of Medicine and Rady Children's Hospital of San Diego, San Diego, California[a]; Carrie L. Byington, Department of Pediatrics, University of Utah School of Medicine, Salt Lake City, Utah[a]; Samir S. Shah, Departments of Pediatrics, and Biostatistics and Epidemiology, University of Pennsylvania School of Medicine, and Division of Infectious Diseases, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania[a]; Brian Alverson, Department of Pediatrics, Rhode Island Hospital, Providence, Rhode Island; Edward R. Carter, Pulmonary Division, Seattle Children's Hospital, Seattle, Washington; Christopher Harrison, Department of Pediatrics, Children's Mercy Hospital, Kansas City, Missouri; Sheldon L. Kaplan, Department of Pediatrics, Baylor College of Medicine, Houston, Texas; Sharon E. Mace, Department of Emergency Medicine, Cleveland Clinic, Cleveland, Ohio; George H. McCracken, Jr, Department of Pediatrics, University of Texas Southwestern, Dallas, Texas; Matthew R. Moore, Centers for Disease Control and Prevention, Atlanta, Georgia; Shawn D. St Peter, Department of Pediatrics, University of Missouri–Kansas City School of Medicine, Kansas City, Missouri; Jana A. Stockwell, Department of Pediatrics, Emory University School of Medicine, Atlanta, Georgia; and Jack T. Swanson, Department of Pediatrics, McFarland Clinic, Ames, Iowa

[a]J. S. B., C. L. B., and S. S. S. contributed equally to this work.

Financial Disclosures/Conflicts of Interest

All members of the expert panel complied with the Infectious Diseases Society of America (IDSA) policy on conflicts of interest that requires disclosure of any financial or other interest that might be construed as constituting an actual, potential, or apparent conflict. They were given the IDSA conflicts of interest disclosure statement and were asked to identify ties to companies developing products that might be affected by promulgation of the guidelines. Information was requested regarding employment, consultancies, stock ownership, honoraria, research funding, expert testimony, and membership on company advisory committees. The panel made decisions on a case-by-case basis as to whether an individual's role should be limited as a result of a conflict.

Potential conflicts of interest: J. S. B. has received no pharmaceutical funding or support during the past 36 months for management of pediatric CAP. C. L. B. served as principal investigator on Wyeth/Pfizer clinical trials of PCV13; the funding was to her employer, the University of Utah. C. H. has received honoraria from Sanofi Pasteur, and his employer has received grant funds for research performed by C. H. from Johnson & Johnson Pharmaceuticals, Cubist, Merck, Sanofi Pasteur, Astellas, and GlaxoSmithKline. S. L. K. has served as a consultant for Pfizer, GlaxoSmithKline, and Novartis. S. E.M. has served as principal investigator on a Gebauer clinical trial for vapocoolant and a clinical site investigator for a multicenter Baxter Hylenex clinical trial—the funding for both trials was to her employer, the Cleveland Clinic; she has also served as consultant for Baxter Health Care, Halozyme Therapeutics, Pricara (Ortho-McNeil-Janssen), Rox-888, and Venasite. J. A. S. has given expert testimony for Finley, Alt, Smith, and Schamberg. S. S. S. receives research support from the National Institutes of Health and the Robert Wood Johnson Foundation. He received past research support from Wyeth Pharmaceuticals (completed September 2009); the funding was to his employer. All other authors: No reported conflicts.

All authors have submitted the International Committee of Medical Journal Editors Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Guideline Endorser(s)

American Academy of Pediatrics - Medical Specialty Society

American College of Emergency Physicians - Medical Specialty Society

American Society for Microbiology - Professional Association

American Thoracic Society - Medical Specialty Society

Society for Hospital Medicine - Professional Association

Society of Critical Care Medicine - Professional Association

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the Infectious Diseases Society of America (IDSA) Web site .

Print copies: Available from Infectious Diseases Society of America, 1300 Wilson Boulevard, Suite 300, Arlington, VA 22209.

Availability of Companion Documents

Suggested performance measures are provided in the original guideline document .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on November 7, 2011. The information was verified by the guideline developer on December 21, 2011.

Copyright Statement

Disclaimer

NGC Disclaimer

The National Guideline Clearinghouseâ„¢ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at http://www.guideline.gov/about/inclusion-criteria.aspx.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.